

551.506 (265.2)

NORTH PACIFIC OCEAN

By WILLIS E. HURD

Gales were more widespread over the North Pacific Ocean in November than in October, but, except in isolated localities, were not so severe. In October several gales of hurricane force resulted from typhoons near the Philippines and east of Japan; in November the highest reported wind force was 11, occurring in connection with extra-tropical cyclones, two west and one east of the one hundred and eightieth meridian. On the 9th and 10th the Norwegian steamer *Handicap* encountered one of these storm winds in the neighborhood of 46° N., 170° E. The American steamer *President Jackson* experienced the second on the 15th and 16th near 46° N., 158° E., in both cases pressure falling below 29 inches. On the 24th and 25th the American steamer *Lurline* fell in with similarly severe gales near 41° N., 137° W. In addition scattered gales of force 10 occurred on several dates. Storm conditions along the upper coast of the United States were, however, considerably severer than in October. Tatoosh Island, Wash., recorded a maximum velocity of 72 miles from the east on the 20th, beside other winds of 60 or more miles an hour on the 11th, 19th, 21st, and 29th.

No typhoons appear to have formed in the Far East, at least none of great extent. The American steamer *Stockton*, bound toward Manila, on the 4th experienced "a local disturbance reaching force 6-7 from south-southeast, with a heavy south-southeasterly swell running." This was in 19° 02' N., 144° 25' E., and was due to a depression central slightly to the westward on that date. This depression, slightly intensified, was central near 27° N., 140° E., on the following day, but thereafter was lost to observation.

Northers were frequent over the Gulf of Tehuantepec, though steamers reported none of force higher than 9. Gales of force 8 and 9 occurred here on the 5th, 6th, 9th, 10th, 15th, 18th, 20th, 22d, and 23d.

A storm of moderate intensity crossed central Japan on the 13th and 14th, and another disturbance, coming out of the Eastern Sea on the 21st, proceeded along the southern coast of Japan on the 22d, thence up the east coast on the 23d, whence it disappeared at sea. A storm of much greater intensity came out of Siberia on the 24th. It covered the Japan Sea on the 26th, crossed extreme northern Japan on the 27th, and was over the far western Aleutians at the close of the month.

As November opened the Aleutian Low extended from central Alaska to the Hawaiian Islands, with the eastern North Pacific HIGH lying between the one hundred and eightieth meridian of west longitude and the American

coast from eastern Alaska southward. After the 10th of the month the Low retreated northward, and by the 13th the HIGH dominated the eastern half of the ocean below the 45th parallel, except for a narrow trough of the Low which was wedged southward along the one hundred and fiftieth meridian. On the 14th this southern extension was cut off from the main cyclone, then central over the eastern part of Bering Sea, and from it a new cyclone developed rapidly near 35° N., 142° W., giving moderate to whole gales over a narrow area midway between California and the Hawaiian Islands. An isolated portion of this new cyclone cut its way to the Washington coast, which it entered on the 15th, but the main storm area spread gradually from its center of the 14th, until by the 22d it covered the whole northern half of the ocean east of the one hundred and eightieth meridian, which great area it dominated until the end of the month, causing irregularly distributed gales throughout the period.

The following table gives an idea of the atmospheric pressure at selected land stations:

TABLE 1.—Averages, departures, and extremes of atmospheric pressures at sea level at indicated hours, North Pacific Ocean, November, 1926

Stations	Average pressure	Departure from normal	Highest	Date	Lowest	Date
	Inches	Inch	Inches		Inches	
Dutch Harbor ^{1,2}	29.44	-0.15	30.26	19th.....	28.78	4th.
St. Paul ¹	29.54	-0.08	30.36	18th.....	28.74	2d.
Kodiak ¹	29.56	+0.02	30.40	19th.....	28.84	11th.
Midway Island ¹	30.02	-0.05	30.22	14th.....	29.74	25th.
Honolulu ³	30.04	+0.02	30.12	22d.....	29.88	1st.
Juneau ³	29.83	+0.07	30.45	18th.....	29.04	11th.
Tatoosh Island ^{3,4}	29.86	-0.11	30.49	16th.....	29.17	24th.
San Francisco ^{3,4}	30.04	-0.06	30.36	14th.....	29.60	26th.
San Diego ^{3,4}	30.04	+0.04	30.22	15th.....	29.75	7th.

¹ P. m. observations only.

² 29 days.

³ A. m. and p. m. observations.

⁴ Corrected to 24-hour mean.

At Honolulu the prevailing wind was from the north-east, with an average velocity of 8.1 miles per hour. During the daylight hours of the 14th, which was an exceptionally windy day, the average velocity was 27 miles an hour, with a maximum of 48 miles from the east. Only 0.12 inch of rain fell, which is 3.72 inches below the normal, and is the least of record for the month, and near the least for any month in 41 years.

Fog conditions did not differ materially from those of October, most frequent fog being observed along the American coast from a little north of San Francisco down to Cape San Lucas. Along the northern and central steamship routes it occurred on a few scattered days, but was especially widespread on the 15th and 16th.

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DETAILS OF THE WEATHER IN THE UNITED STATES

GENERAL CONDITIONS

The month as a whole may be classed as "cool and wet," with the reservation that parts of the area experienced the opposite conditions. It is noted that precipitation for the last several months has been above the normal over very considerable areas; the current month in the Pacific Coast States and the Plateau region gave abundant rains.

An unusual feature of the month was the occurrence of fully developed tornadoes as elsewhere mentioned. The usual details follow.—A. J. H.

CYCLONES AND ANTICYCLONES

By W. P. DAY

The low-pressure areas were mostly of the Pacific type, especially toward the end of the month, when the air pressure averaged above the normal at Fort Simpson in the Mackenzie Valley. And for a similar reason most of the migratory HIGHS were of the so-called Alberta type. There were 19 low-pressure areas, four of which developed considerable intensity over the Plains States and gave severe weather as they passed over the Lake region. The high-pressure areas numbered 14 and 9

of these might be classed as polar outbursts, while the remainder were mostly cold fronts which had traversed the Pacific. In spite of the rather marked outflow of polar air, the individual cold-air masses did not cause any unusual depressions of temperature.

FREE-AIR SUMMARY

By L. T. SAMUELS

Temperature departures for the month were negative at all stations and levels, the greatest departures occurring at Ellendale, the northermost station. (See Table 1.) The small average lapse rate for the month at this station is a characteristic feature of these higher latitudes during the cold season. It will be seen that the mean temperature was practically no lower at 2,000 meters than at the surface. This small lapse rate becomes even more pronounced and in fact changes to negative to an increasing altitude as the winter advances.

Close agreement is found in the monthly mean temperatures for Broken Arrow, Ellendale, and Groesbeck and the resultant winds at these respective stations. It will be seen in Table 2 that there occurred at the above-mentioned stations either a greater northerly or smaller southerly component than normally. Rather marked exceptions in this respect occur, however, at Royal Center and Due West where despite a deficiency in the monthly mean temperatures the resultant winds contain a greater south component than normally. This anomaly was probably caused by the temperatures at the latter two stations being sufficiently low, on most of the days when the winds were northerly, to offset the relatively high temperatures occurring with southerly winds, even though the latter direction predominated in the resultants.

Relative humidity and vapor pressure departures indicated nothing unusual, the former being mostly positive and the latter negative. (See Table 1.)

Exceptionally strong winds prevailed at various elevations above the surface at a number of stations on the 25th, 26th, and 27th. During this period the center of an extensive low pressure area moved rapidly from Colorado to Quebec. On the morning of the first day Oklahoma City being ideally situated with respect to the low's center the pilot balloon observation showed the characteristic wind structure occurring in the southeast quadrant of a pronounced cyclone, viz, a rapid and marked increase in wind velocity off the surface to 600 meters (7 to 24 m. p. s.) followed by practically no change to 3,000 meters. The observation ended a few hundred meters higher and indicated a decrease in velocity in this upper stratum. The direction was south at the surface and veered to southwest at 600 meters where it remained to the highest altitude reached.

The far-reaching influence of this storm may be realized from the fact that on the 27th with its center over Quebec the wind at 5,000 meters above Atlanta, Ga., was 42 meters per second from the west-northwest and substantially the same at Due West, S. C., about 100 miles to the east. While such tremendous velocities prevailed at these elevations the winds in the lower layers were only light to moderate.

An unusually marked rise in temperature at an elevation of 2,500 meters, while during the same interval a much smaller increase occurred at the surface, is shown by the Broken Arrow kite records for November 21 and 22.

It will be seen from the above table that at the 2,500 meters level the temperature was 8.8° C. higher on the 22d than on the 21st. The increase in surface temperature during this time was only 4.5° C. On the morning

of the 21st this station was in the southeast quadrant of a strong anticyclone whose major axis lay in a northwest-southeast direction and low temperatures and northerly winds prevailed. During the following 24 hours an unusually large and rapid movement of the upper (northern) portion of this HIGH took place, while the lower (southern) portion remained practically stationary, so that the major axis took an east-northeast west-southwest direction with Broken Arrow in the southwest quadrant. Warm southerly winds now raised the temperature in the upper strata to the extent shown above, while the effects of nocturnal radiation prevented such a large increase in the lower air until a considerably later hour in the day. It is of interest to note that exceptionally strong westerly winds prevailed from 1 to 3 kilometers over the northern Plains States, upper Mississippi and Ohio River Valleys coincidentally with the rapid movement eastward of the northern portion of this anticyclone.

Altitude (m.) m. s. l.	21st (8 to 9 a. m.)		22d (7.30 to 10.30 a. m.)	
	Temperature	Wind direction	Temperature	Wind direction
233 (surface)	-3.5	N	-4.8	SW.
500	-6.2	N	-4.2	SSW.
1,000	-7.5	N	-2.6	SW.
1,500	-4.5	NNE	1.0	SW.
2,000	-1.6	NNE	1.5	SW.
2,500	-3.1	NW	5.7	W.
3,000	-4.1	WNW	2.9	WNW.

TABLE 1.—Free-air temperatures, relative humidities, and vapor pressures during November, 1926

Altitude, (m.)	TEMPERATURE (° C.)									
	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean
Surface	6.8	-2.7	9.1	-1.6	-5.3	-3.1	11.6	-1.2	2.3	-2.1
250	6.7	-2.7	8.9	-1.6	---	---	11.3	-1.3	2.1	-2.1
500	5.3	-3.2	7.7	-1.8	-5.6	-3.4	10.6	-1.4	0.9	-1.9
750	4.3	-3.4	7.1	-1.5	-6.4	-4.3	10.0	-1.4	0.2	-1.8
1,000	4.0	-3.2	6.0	-1.7	-5.7	-3.8	9.4	-1.5	-0.3	-1.7
1,250	3.9	-2.8	5.4	-1.7	-5.0	-3.1	8.8	-1.4	-0.9	-1.7
1,500	3.8	-2.2	4.2	-2.1	-4.6	-2.5	7.9	-1.5	-1.4	-1.6
2,000	2.8	-1.4	2.3	-2.4	-5.4	-1.9	5.7	-1.8	-3.4	-1.8
2,500	1.0	-1.0	0.9	-2.1	-6.8	-1.2	3.8	-1.7	-5.2	-1.8
3,000	-1.4	-1.0	0.0	-0.8	-9.7	-1.5	2.2	-0.9	-7.8	-2.1
3,500	-4.8	-1.9	-3.0	-1.1	-12.6	-1.6	-1.1	-1.4	-9.0	-1.3
4,000	-8.1	-2.7	---	---	-15.9	-2.0	-3.4	-1.0	-11.8	-1.1
4,500	-11.3	-3.3	---	---	-19.3	-2.5	-5.6	-0.3	-14.2	-0.8

Altitude, (m.)	RELATIVE HUMIDITY (%)									
	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean
Surface	68	+2	70	+2	83	+4	68	-6	74	+1
250	68	+2	70	+3	---	---	66	-6	74	+1
500	66	+4	68	+3	83	+5	64	-3	72	0
750	64	+5	68	+7	81	+8	62	-1	71	+1
1,000	60	+4	70	+10	76	+8	60	+1	68	+2
1,250	54	+1	65	+8	72	+8	55	-1	64	+2
1,500	49	-1	61	+7	69	+8	52	-1	59	+1
2,000	41	-4	55	+8	66	+9	45	-3	56	+3
2,500	35	-7	43	+3	68	+11	37	-5	51	+2
3,000	38	-3	30	-8	69	+12	37	-2	52	+5
3,500	49	+10	30	-8	73	+15	37	-1	47	+2
4,000	61	+26	---	---	72	+11	36	+1	50	+6
4,500	61	+29	---	---	71	+9	37	+3	56	+12

Altitude, (m.)	VAPOR PRESSURE (mb.)									
	Broken Arrow, Okla. (233 meters)		Due West, S. C. (217 meters)		Ellendale, N. Dak. (444 meters)		Groesbeck, Tex. (141 meters)		Royal Center, Ind. (225 meters)	
	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean	Mean	De- parture from 9-year mean
Surface	7.15	-0.79	8.79	-0.32	3.48	-0.83	9.78	-1.82	5.48	-0.85
250	7.08	-0.79	8.61	-0.33	---	---	9.41	-1.73	4.91	-1.35
500	6.39	-0.73	7.95	+0.04	3.38	-0.85	8.73	-1.28	4.36	-1.24
750	5.77	-0.72	7.79	-0.57	3.13	-0.80	8.11	-0.85	3.99	-1.10
1,000	5.10	-0.85	7.32	-0.67	3.06	-0.58	7.50	-0.58	3.60	-0.95
1,250	4.39	-1.00	6.35	+0.41	3.00	-0.39	6.54	-0.65	3.21	-0.82
1,500	3.71	-1.11	5.40	+0.17	2.95	-0.21	5.62	-0.77	2.79	-0.79
2,000	2.86	-0.96	4.06	+0.17	2.58	-0.10	3.92	-0.97	2.26	-0.62
2,500	2.30	-0.72	2.71	-0.15	2.34	+0.06	2.77	-0.70	1.77	-0.51
3,000	2.02	-0.44	1.70	-0.54	1.86	+0.02	2.81	+0.10	1.39	-0.58
3,500	2.04	+0.18	1.18	-0.63	1.56	+0.01	2.59	+0.48	1.04	-0.57
4,000	1.98	+0.69	---	---	1.19	-0.10	2.45	+0.94	0.73	-0.35
4,500	1.90	+0.98	---	---	0.85	-0.27	2.37	+1.32	0.65	-0.12

1 Naval air station.